MARSH

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Thinking On Your Feet
Controlling Slips, Trips and Falls

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GOAL

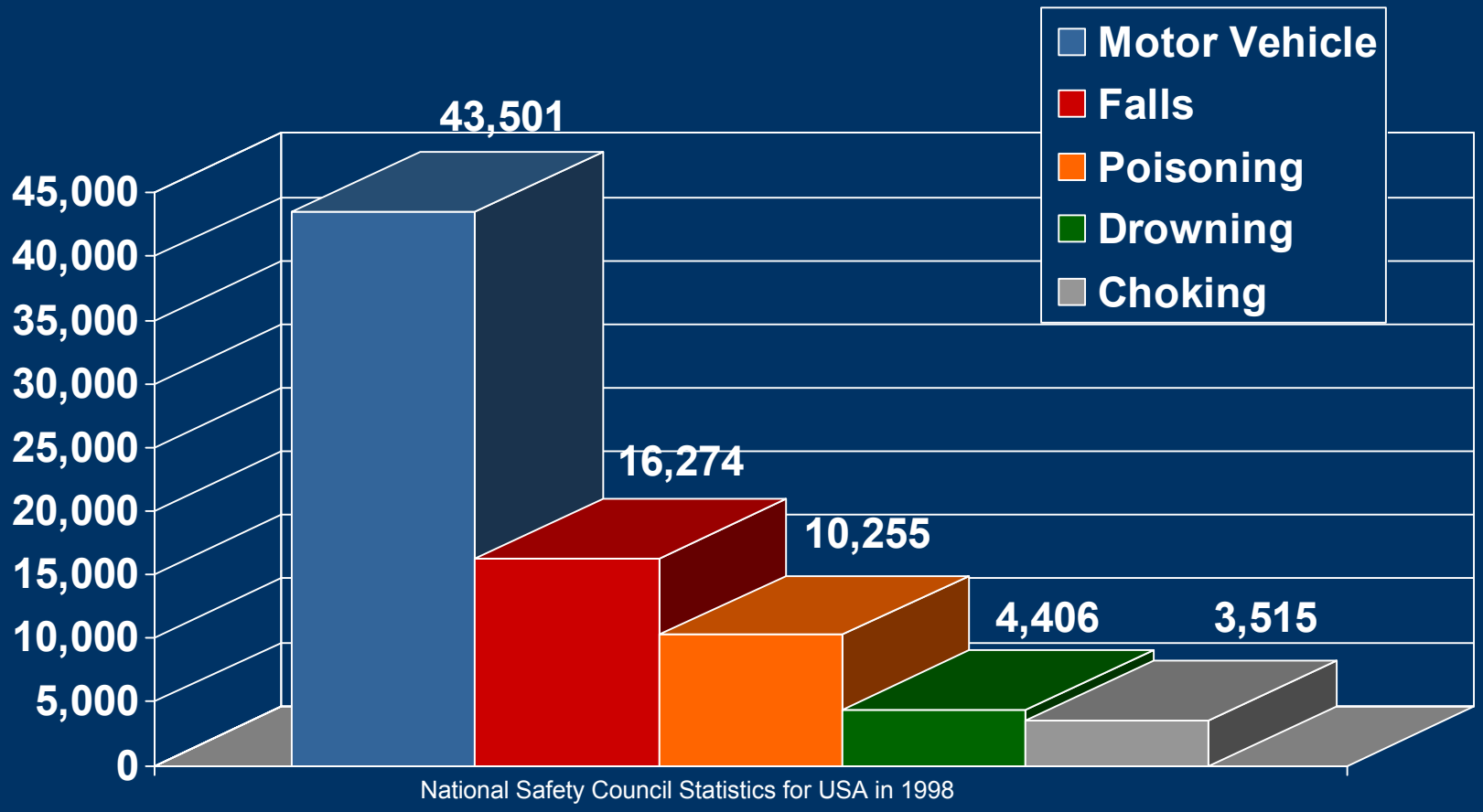
To discuss strategies focused on reducing slip, trip, and fall hazards in public buildings

Talking Points

- Statistics
- Causes of Slips, Trips & Falls
- Prevention Measures & Controls
- Standards and regulations
- Claims Management
- Question & Answer

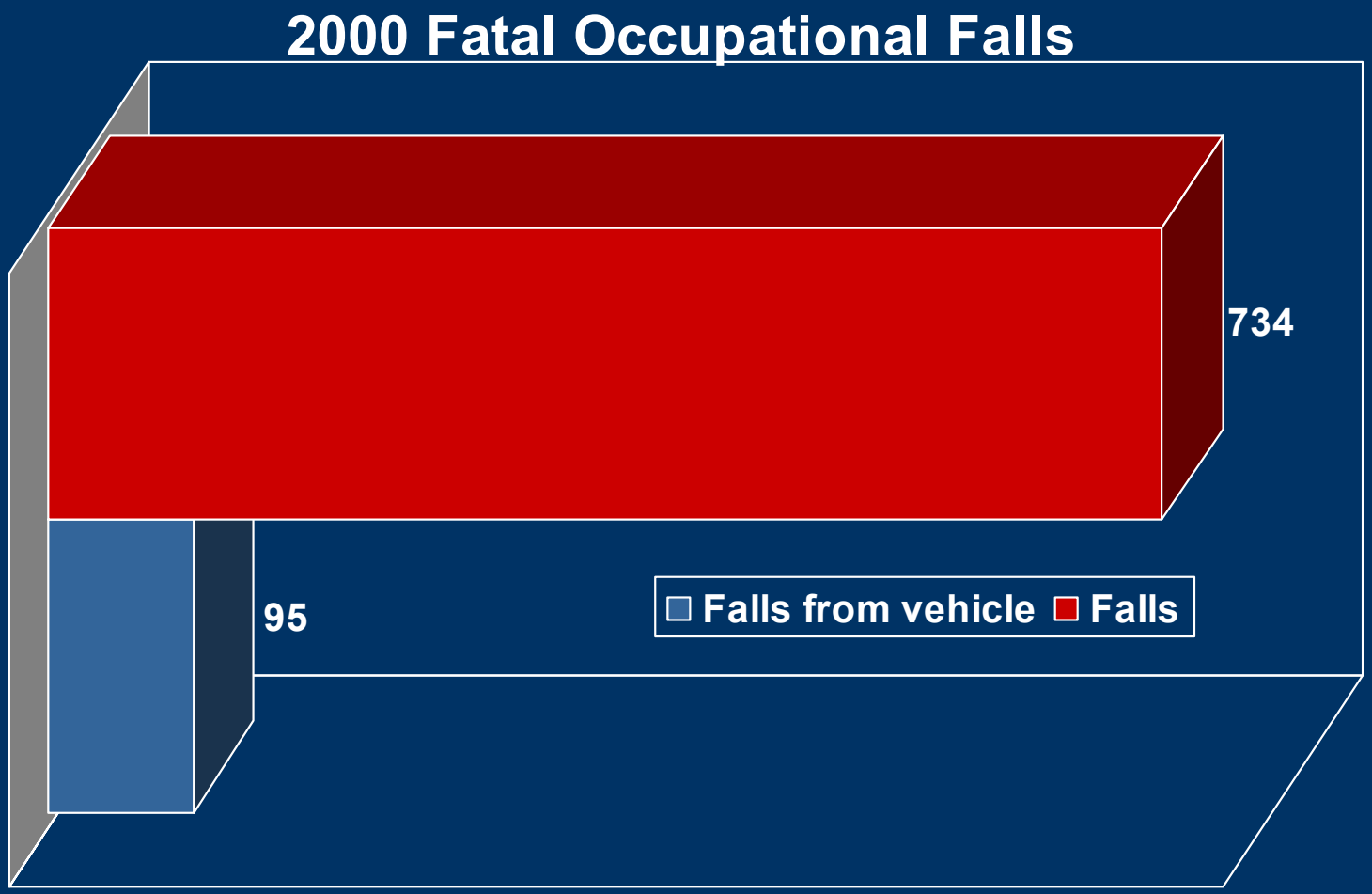
Unintentional Injuries

Leading Causes of "Unintentional-Injury" Deaths



National Safety Council Statistics for USA in 1998

Statistics


2000 Fatal Occupational Falls
734
95
Falls from vehicle
Falls

What causes slipping?

- "**The friction between the shoe material and the walking surface** does not provide sufficient slip resistance to counteract the forward, resultant, forces at the point of contact (usually the heel). And/or...
- **Contaminants present** sufficient that the slip resistance between the surfaces is severely lessened because of a decrease (or absence) of the shoe's contact with the surface." And,
- **Many other factors** some of which are beyond your control
- **Key: Control what you can?**

Primary Causes of SLIPS

- Smooth floor surfaces that have spilled liquids, food, rain, mud or grease on them .

  *Often, these substances are not seen on the floor surface because of **poor lighting**, poor contrast between the floor and the spilled substance, or because the area is crowded with people.*

- Improper footwear

  Leather soled shoes have a lower coefficient of friction than most rubber soled shoes. Women's platform shoes (spiked heels) can also be hazardous because of their high center of gravity, relatively no ankle support, and small heel cross sectional area available to contact the floor surface.

- *Poor housekeeping*

Causes of Slips -- Wet Floors

Awareness sign for rainy weather or liquid spills. Should you consider other languages?

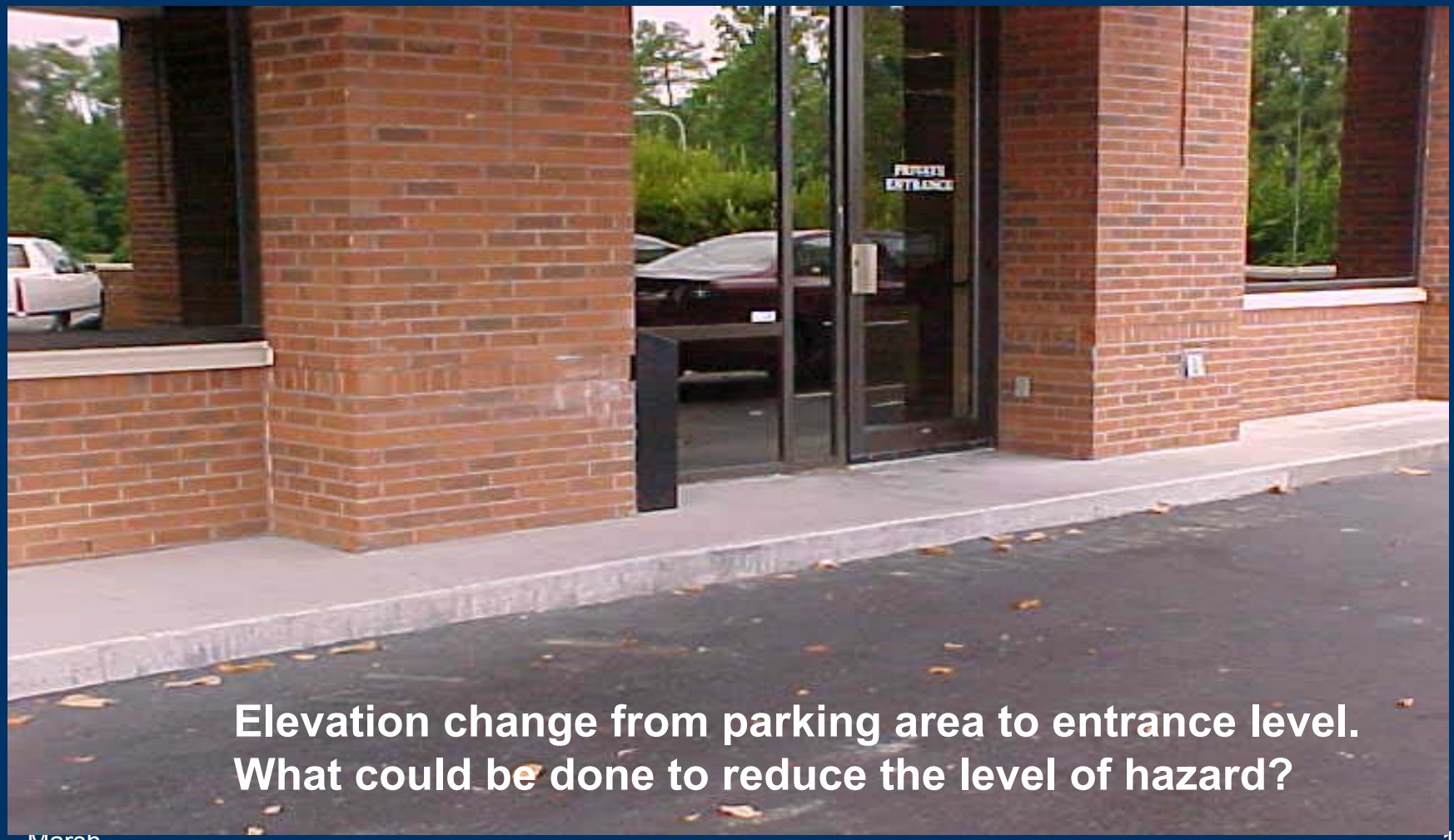
Causes of Slips -- Wet Floors

Carpet surfaced mats at main entrance are good for inclement weather. Where traffic is heavy enough to saturate the mats, it may be necessary to keep an extra set on hand.

Primary Cause of TRIPS

The major source of trips is from minor abrupt changes in elevation.

Causes of Trips -- Elevation Changes



Elevation change from parking area to entrance level.
What could be done to reduce the level of hazard?

Other Causes of TRIPS

- unseen speed bumps in parking areas
- concrete car tire bumpers
- curbs
- sidewalk changes due to slab lifting from tree roots
- extension cords stretched across floors
- floor mats that are too thick or have rolled up
- rugs that have bunched up
- poor lighting
- deteriorated or worn carpeting
- objects stored in aisles
- *poor housekeeping*

Causes of Trips

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Causes of Trips

Mats are great for wet weather. But they can create a hazard if not properly maintained.

Causes of Trips - Housekeeping

Causes of Trips - Housekeeping

Causes of Trips - Housekeeping

Primary Causes of FALLS

- Same level *(most frequent)*
  - Slips
  - Trips
- Elevated level *(most severe)*
  - Equipment/Truck beds
  - Stairs
  - Misuse & abuse of Ladders
  - No fall protection on elevated work surfaces
    - platforms
    - roofs

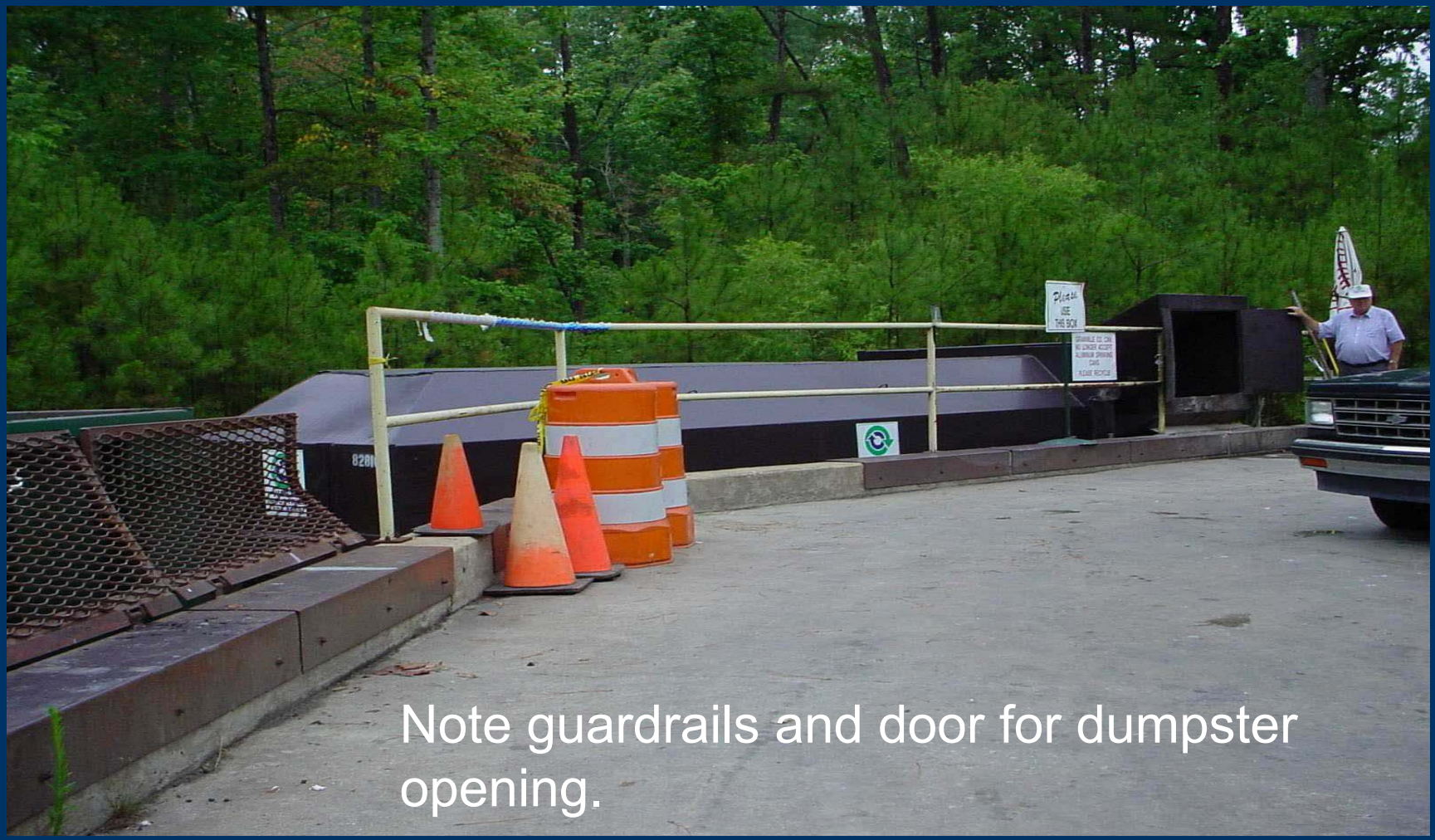
Causes of Falls -- Stairs

Causes of Falls From Elevations

Open sides?

Causes of Falls From Elevations

Causes of Falls From Elevations

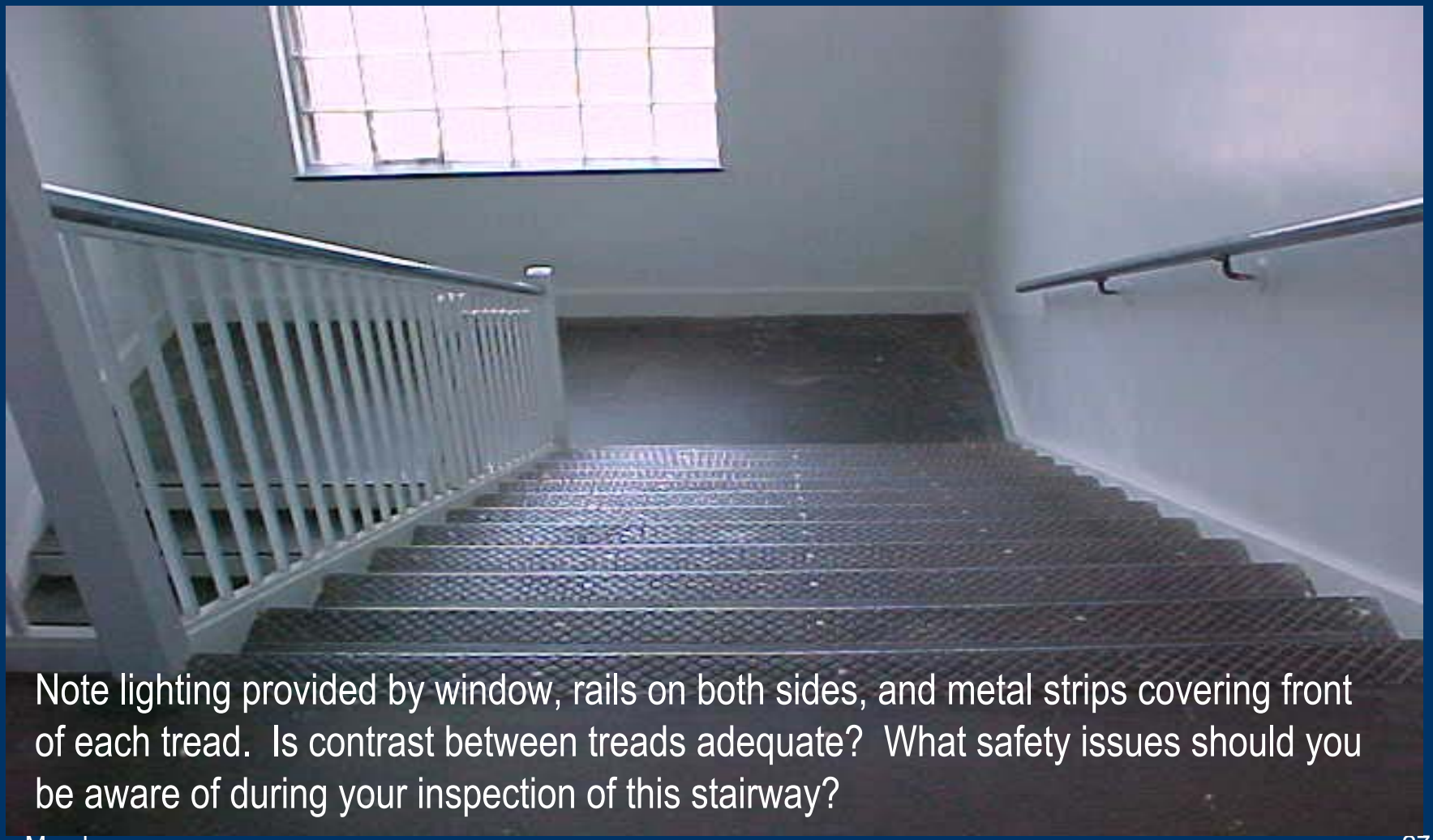


Note guardrails and door for dumpster opening.

Falls on Stairways

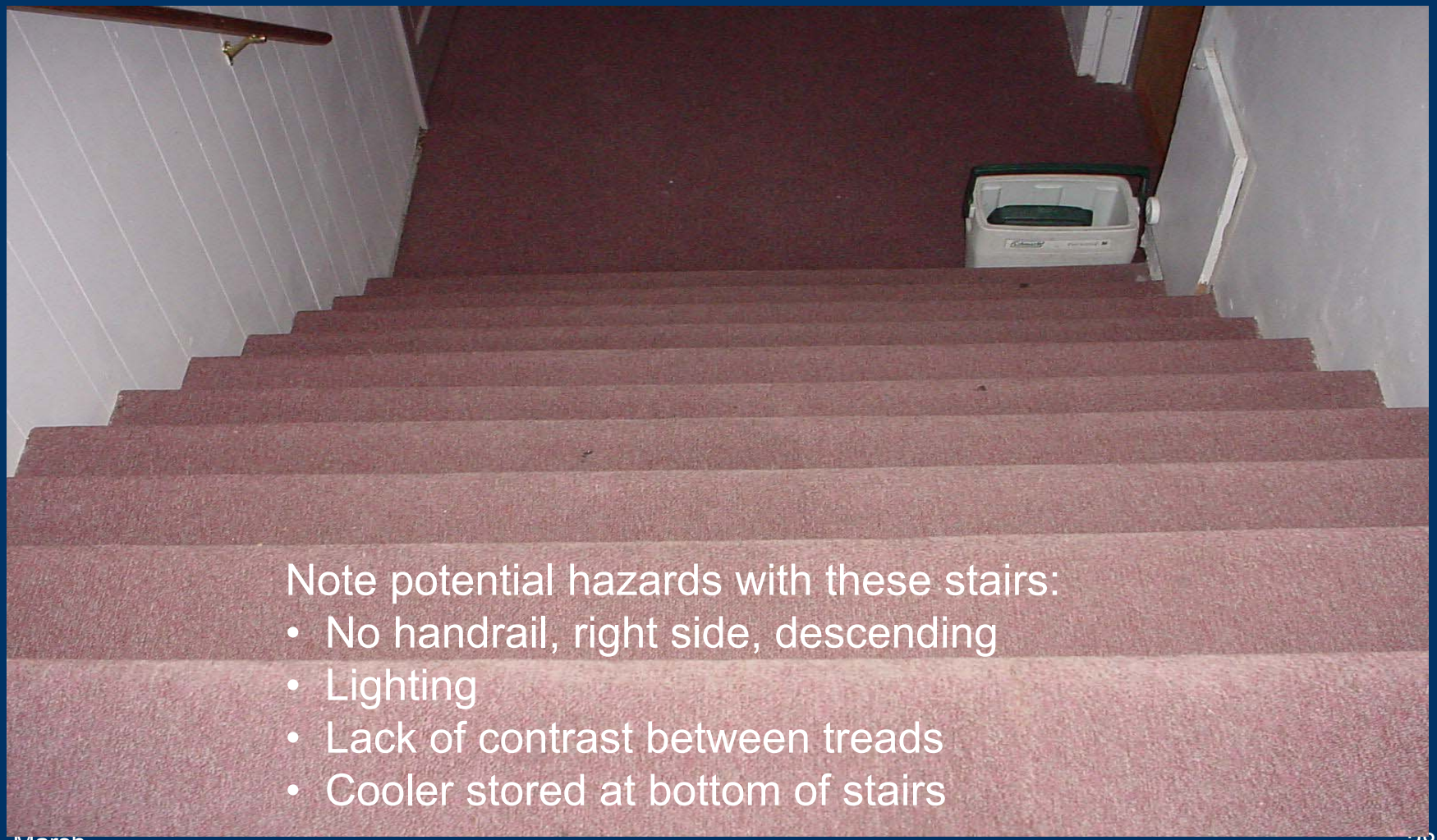
- **Primary causes for slips, trips, & falls**
  - Stairways not having handrails/guardrails
  - Improper or varying tread heights
  - Slick stairs - no traction
  - Carrying too large a load
  - Inadequate lighting
  - ***Poor housekeeping***
  - Deteriorated flooring on stairs

Falls on Stairways



Note lighting provided by window, rails on both sides, and metal strips covering front of each tread. Is contrast between treads adequate? What safety issues should you be aware of during your inspection of this stairway?

Falls on Stairways



Note potential hazards with these stairs:

- No handrail, right side, descending
- Lighting
- Lack of contrast between treads
- Cooler stored at bottom of stairs

Falls on Stairways

Falls on Stairways

Should this set of steps have a stair rail? Both sides? Middle? How would you protect the open side?

Slips, Trips & Falls
Other Contributing Factors

Personal Factors

- Age
- Body shape, size/mass - heel strike force
- Gait dynamics - walking speed; heel strike angle
- Shoe type, material, condition
- Physical condition
- Visual & tactile perception, complacency
- Psychological/psychosocial/stress/distractions
- Opportunist

Slips, Trips & Falls
Other Contributing Factors

Task Factors

- Object carried - weight, shape, location
- Pushing/pulling
- Change in elevation or direction (>1/4”)
  - **trip hazards**

Environment Factors

- Temperature and humidity
- Precipitation
- Traffic volume, type
- Lighting level or quality

Slips, Trips & Falls - Other Factors

Minor Elevation Changes

Slips, Trips & Falls - Other Factors

Minor Elevation Changes

Slips, Trips & Falls - Other Factors

Minor Elevation Changes

Slips, Trips & Falls - Other Factors

Minor Elevation Changes

Change in elevation from sidewalk to floor level inside building. What action would you recommend to control this hazard?

Slips, Trips & Falls
Other Contributing Factors

Surface Factors

- Floor material, resistance, roughness, wear
- Irregularities (>1/4”)
  - **trip hazards**
- Contaminant load - control at source
- Cleaning methods
- Cleaning chemistry suited for types of contamination, e.g.- polymerized grease, minerals

Some of these factors are beyond your control

Key: Control what you can

Control Opportunities - Tap the Potential

Reactive Response

Pro-active Control

1

?

??

???

Slip/fall injury/claim

S/F - no injury identified/reported

S/F - no injury - not aware/no report

Potentials - design for slips, unsafe conditions improper work practices at-risk behaviors, co-related incidents, e.g. MMH

Reality Check

- “It is not the CoF of the walking surface that predicts the occurrence of a slip/trip/fall….
- …It is the sudden occurrence of an unexpected slippery spot under foot or change in terrain…(+*ability to recover from it*)
- … It is the difference between slip resistance values for lubricated and dry surface conditions.”
- … It is the failure to control contaminant load

Reality Check

Scientific literature on fall occurrence recognizes that:

- Floor surface
- Shoe bottom
- Environmental contaminants, &
- Gait dynamics

...all affect floor friction during walking.

All can be controlled to varying degrees.

Slips
Controllability of Causation Factors

	Employee Falls	Guest Falls
Floor Material	Yes	Yes
Floor S/R	Yes	Yes
Footwear	Some	No
Contaminants	Some	Some
Gait Dynamics	Limited	No
Tasks	Some	No
Environment	Limited	Limited

Slips
Measurement assists in control - ***TRIBOMETRY***

What should we measure?

Static COF - the force required to initiate relative motion between an object and a surface it is resting on.

Dynamic COF - the force required to keep a sliding object in motion, once sliding has begun.

Slip resistance or Slip Index - "the relative force which resists the tendency of a shoe or foot to slide along a walkway surface." (ASTM F1637.95)

Slip Meters - Tribometers

- Hunter (1929)
- James Machine
- Topaka
- Tortus
- British Portable Skid Tester
- Sigler Pendulum Tester
- SATRA Shoe Tester
- Sellmaier
- **Brungraber Mark II**
- **English XL (VIT)**

Either outdated or cannot give valid/reliable readings on wet surfaces

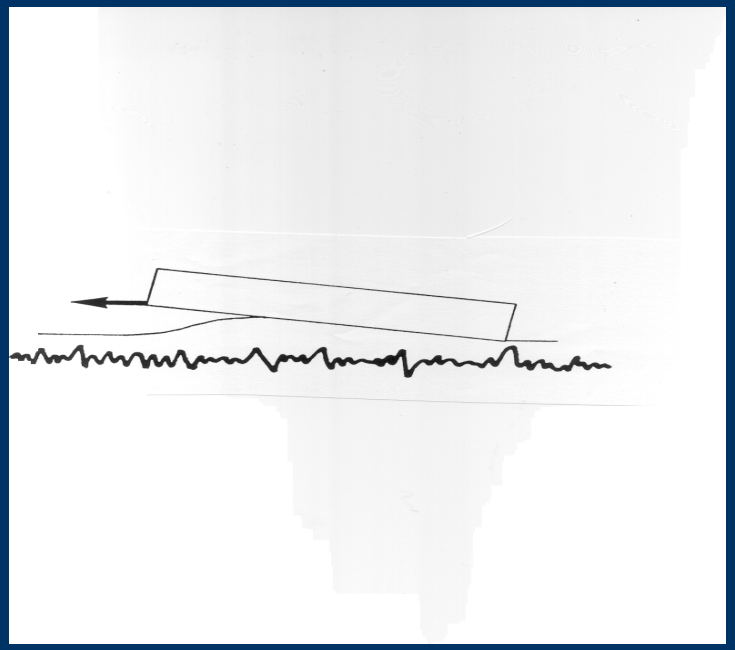
Only meters with ASTM standard methods valid for use on wet surfaces, and referenced in OSHA and ANSI standards

Slip Meters - Useful Qualities

- Easy to Use
- Portable, For Field Use
- Use on Wet or Contaminated Surfaces
- Use on Ramps and Stairs
- Precision & Bias
- Closely models motion of ankle/foot
- Reasonable Purchase Cost
- Ease of Maintenance
- Does not have “sticktion” problem

Slip Controls
Start with slip resistant floor

- Floor type - sharp “asperities” (i.e. highs/lows/contours)
- Etching
- Mechanical Abrasion
- Grooving
- Chemical Coatings
- Trowel-on, paint-on finishes
- Mats of sufficient length -
    - need 6 - 8 footsteps dwell time
- Cleaning chemistry - target contaminants



Slip Control
Key Programs

- Fast response to spills
- “Spill Watch & Action Teams”
    - Ever-vigilant employees
    - Warning signs
    - Proper timing of cleaning
- Control spills/leaks at source
- Establish procedures for cleaning and maintenance
    - responsibility
    - accountability
    - monitoring and supervision
- Footwear optimized for application
- Surveillance cameras at strategic points

Slip Control
Practical Advice

- Start with a reasonably slip resistant floor material
    - Match floor to exposures
    - Balance safety, durability, ability to clean
    - High surface “asperities” (highs/lows; roughness)
    - Test floor under typical conditions, before/after
    - Don’t trust vendors/architects - make them prove it
- Select floor treatment to raise slip resistance; waxes, sealers
- Set/review/alter floor maintenance chemistry or procedures
- Consider shoe selection program for employees and appropriate controls for guests (e.g. mats, warnings)
- Train employees
- Ongoing *inspection*, monitoring, documentation
- Put safety a priority over aesthetics

Inspections

Building Inspections

- conduct at least monthly
- document each inspection
- form should be specific for area being inspected
- include corrective action & follow-up on form
- ensure compliance with these procedures
  - accountability
  - responsibility

Building Inspections

In General, Target

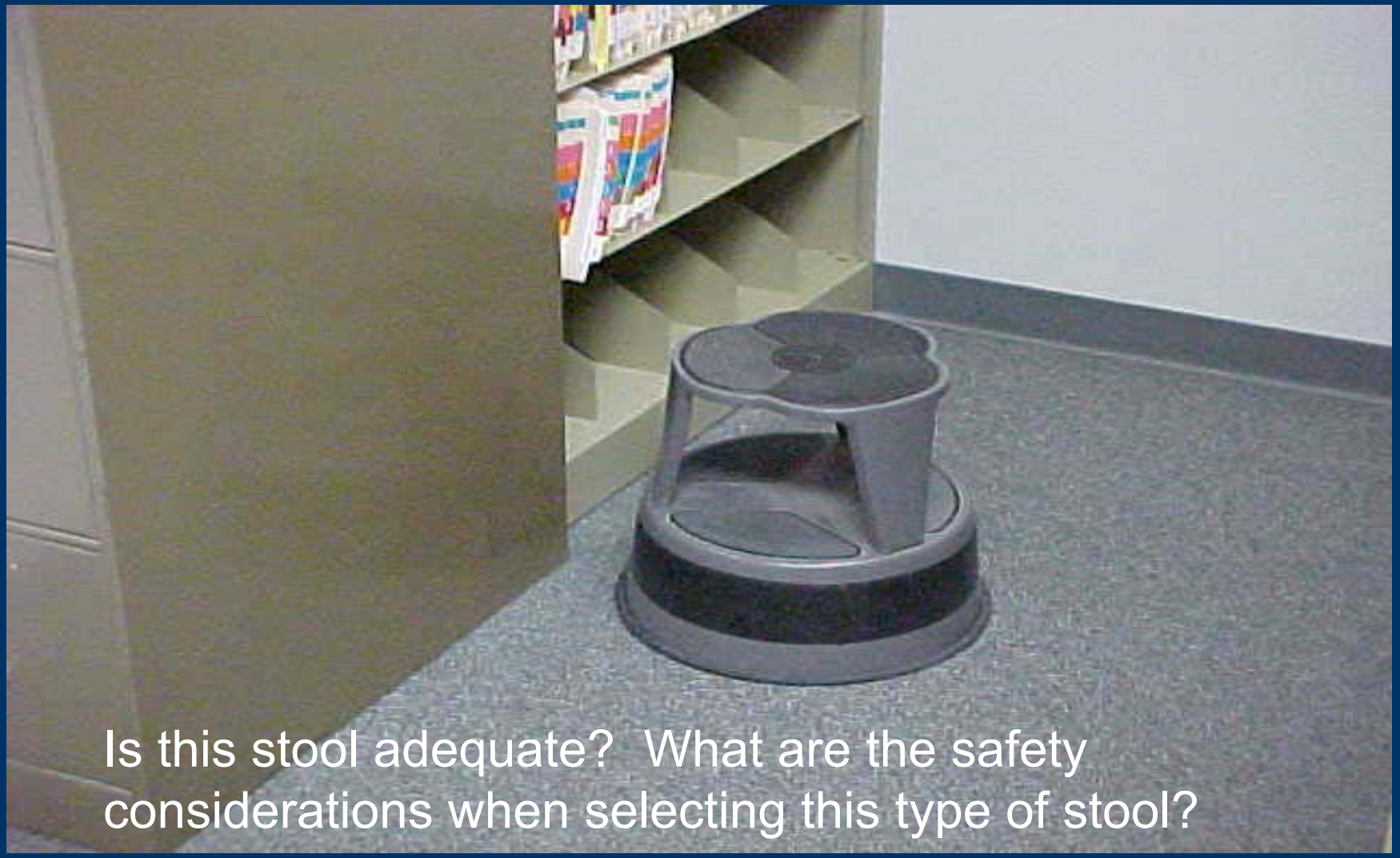
- **Primary causes for slips, trips & falls**
  - cords across walkways
  - rugs rolled or bunched up
  - unmounted fire extinguishers
  - uneven surfaces
  - slippery or slick floors/stairs (waxed, wet) - no wet floor sign
  - ***poor housekeeping***
  - inadequate lighting

Building Inspections

Key to Good Housekeeping

- Keep aisles clean, clear & unobstructed
- Keep storage closets orderly & uncluttered
- Clean up spills immediately
- Place wet floor signs when appropriate
- Ensure appropriate rugs are properly placed and not bunched up
- Striping *(mark elevations in floor)*

Fall control
Reaching Elevations



Fall Control

Reaching Elevations

Ladders with spring loaded casters

Accident Investigation Process

- Prompt reporting
- Immediate investigation
- Use of Accident Investigation Form
  - includes corrective action & follow-up
- Accident review *(review board/safety committee)*
- Disciplinary Policy

Shoe Selection Program

- Departments to consider
  - Maintenance
  - Solid Waste
  - Public Works
  - Sheriff's Office
- Shoe Types
  - The soles and heels should be slip-resistant
  - The toe of the shoe should resist crushing injuries
  - The shoe should support the ankle.

Floor Cleaning & Maintenance Procedures

- Written procedures
  - Control spills/leaks at source *(root cause)*
  - Provide fast response to spills *(who to call)*
  - Put safety above appearance
  - Select floor treatment to raise slip resistance if necessary; e.g. protection/sealers
  - Signage (wet floor signs)
  - Ensure use of proper cleaning agents
  - Minimize the use of wax
  - Follow the maintenance procedures specified by the manufacturer for the floor surface material used.

Floor Cleaning & Maintenance Procedures

- Written procedures
  - Ensure that the maintenance/custodial staff is using appropriate cleaning chemicals and waxes that will improve the SCOF, & comply with ASTM D2047, a recommended benchmark for floor polishes & finishes.

Fall Protection Program

A written Fall Protection Program should be developed to guide management, supervisors, and the safety coordinator in preventing and handling falls.

- The Plan should include procedures for information gathering and providing immediate assistance to injured persons.

Slip, Trip, Fall Controls
Practical Advice

- Ensure that the static coefficient of friction (SCOF) of floor surfaces are maintained between at least 0.5 - 0.6.
- Follow all building codes for the design of floors, stairs, and ramp surfaces.
- Keep foreign substances (water, rain, food, liquids, mud) off floors.
- Floors where spills or slippery substances are most likely to occur should be inspected and maintained regularly.
- Provide beveled edged non-skid mats at transition areas of doors or in areas where floors may become wet.
- Provide non-slip flooring or mats in front of public water coolers.
- Non-skid mats should be provided in areas where the public and employees are exposed to potential slipping hazards.
- Employees should be required to wear non-slip footwear, suitable for the environment.

Slip, Trip, Fall Controls
Practical Advice

- Ensure recommended lighting levels are maintained, especially for stairs.
- Have a spill kit and signs readily available for use by personnel.
- Loose surfaces such as floor tiles, carpeting, and stair nosing should be repaired immediately, or the area should be roped off until repairs can be made.
- Speed bumps, tire stops, and accessible ramps in parking areas should be painted/stripped with traffic yellow paint to increase visibility.
- Lighting in parking and exterior walk areas should be adequate to prevent falls (about 0.5 - 1.0 foot-candles minimum)
- Abrupt changes in walkway elevations (caused by tree roots, cracking, and settling) should be repaired.
- Control landscape watering times to those periods where excess run-off will dry by the time normal business hours commence.

U.S. Consensus Standards & Guidelines

- OSHA - General Industry- No mandatory Fed OSHA standard on slip resistance of walking surfaces (General Duty Clause) (1910.68 - manlifts - specifies value, but not how to measure)
- OSHA Construction - 1926.754 c(3) specifies slip index/meter
- Cal/OSHA; Rule Title 24 - "safe" COF
- NFPA - 101 Life Safety Code (ramps), 1901 Auto Apparatus
- Building Codes (BOCA, Southern, UBC, Standard Building Code, Uniform Federal Accessibility Standards)
- **in the Workplace** - specifies slip index 0.50 and ASTM method
- ASTM - F1677-8 (PIAST), F1679 (VIT), D 5859; D2047, C1028...

Consensus/Regulatory Standards

- General Industry - CoF/Slip Index of 0.5 for dry surfaces - generally accepted threshold for a “safe floor”
- ADA - Accessibility Guidelines - Non Mandatory 0.60 on walking surfaces, 0.80 on ramps (refers to dry surface measurement; no meter specified) may be repealed
- OSHA Structural Steel Standard - wet, painted metal surfaces - slip index of 0.6 (Mark II), 0.75 (English XL)
- A - 1264.2 - Provision of Slip Resistance in the Workplace - specifies slip index 0.50 and ASTM method

Internat'l. Consensus Standards & Guidelines

- ISO - TR11220 (1993) - Footwear for professional use
- Can/CSA - Z195 - M92 - Protective footwear
- Australia/NOHSC - AS 3661, 2 - Slip resistance of pedestrian surfaces

Legalities

OSHA Standard 29 CFR 1910.23

- walking & working surfaces

  OSHA's standard for walking and working surfaces apply to all permanent places of employment to minimize slip, trip and fall injuries

  - *housekeeping*
  - *aisles & passageways*
  - *covers & guardrails*
  - *floor loading*
  - *ladders*

OSHA Standard 29 CFR 1910.25

- fixed industrial stairs

  stair treads must be reasonably slip resistant

Legalities

- OSHA General Duty Clause (5)(a)(1)
- Americans With Disabilities Act (ADA)
  - non-mandatory guidelines for slip resistance
- Virginia Workers' Compensation Commission
  - workers' compensation

Claims Management

"Someone, sometime, will fall, and they will sue!"

- An effective claims management program can prevent a lawsuit from escalating out of control, and begins with a written policy and procedure to follow in the event of a claim.

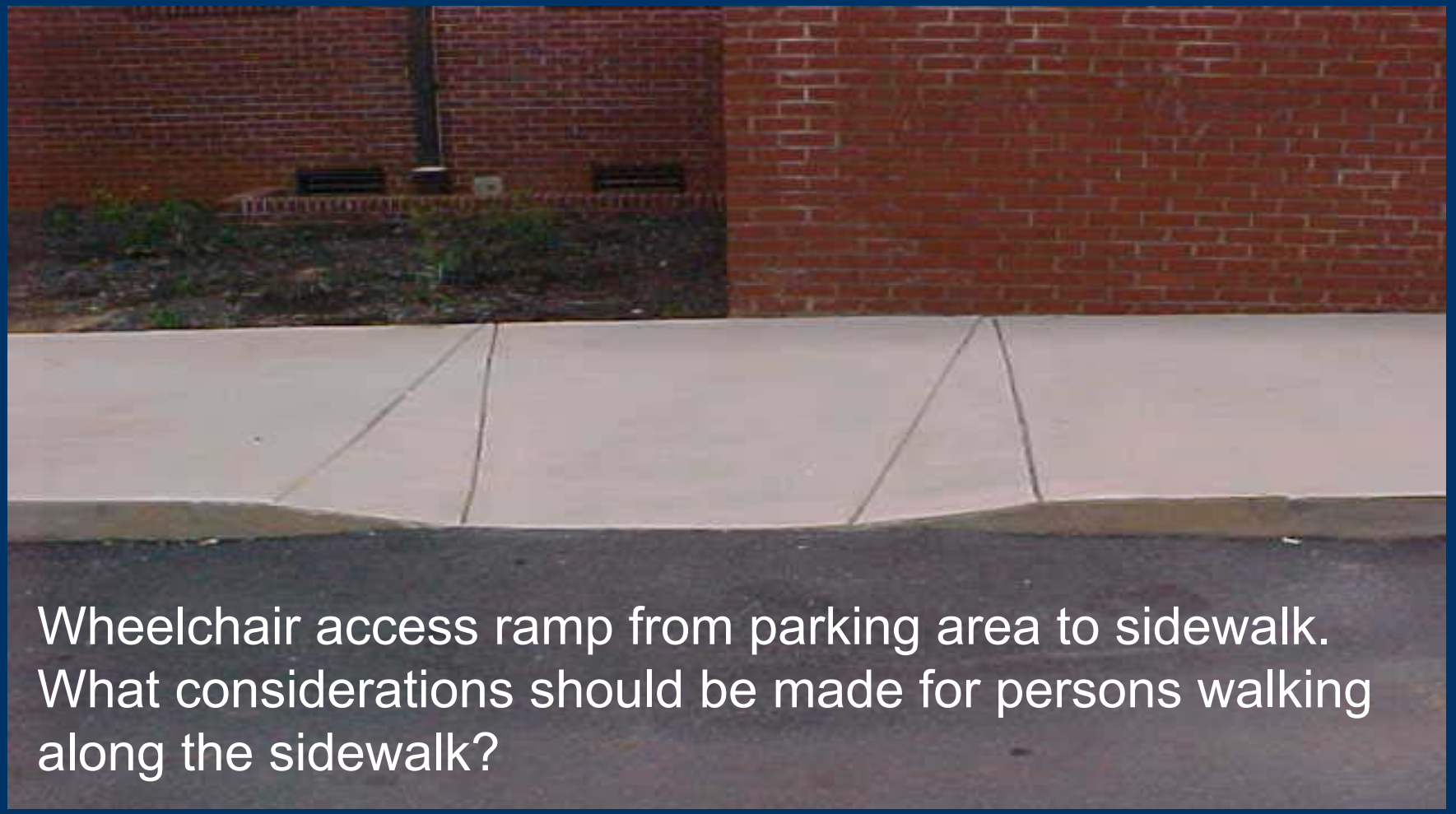
Response to Injuries

- Accident Investigation Policy & Procedure
  - Respond immediately & take the incident seriously
    - *Consider investigation "quick response team"*
  - Treat slip/fall victims with respect
  - Trust no one - prove it
  - Investigate thoroughly
  - Document *(Incident/accident report)*
  - Test floors - after incident

What's Wrong With This Picture?

Other Fall Prevention Issues

Other Fall Prevention Issues



Wheelchair access ramp from parking area to sidewalk. What considerations should be made for persons walking along the sidewalk?

What's Wrong With This Picture?

Walkway to parking area

Parking Lot Slips, Trips, Falls

Asphalt parking area. What safety issues should be considered during an inspection?

Resources

- Internet
  - www.slipandfall.com
  - www.englishXL.com
- Pedestrian Slip Resistance - Bill English
- Liberty Mutual
- Floor Safety Institute (www.nfsi.org)
- ASTM
- ANSI

Questions?